

4. HOW DOES IT FIT TOGETHER?

Regional ITS Architecture

The primary objective of Section 4 is to “de-mystify” the National ITS Architecture and translate its components into practical applications tailored to the Central Coast. Basically, the National ITS Architecture provides the common framework or “blueprint” from which to plan and/or design ITS Projects so that systems are compatible and operations are coordinated. Section 4 presents an overview look at the Architecture, highlighting key points and providing an initial level-of-detail to further illustrate how useful the Architecture is to the ITS practitioner at the project level. For a more in-depth understanding and detailed description of the Architecture, readers are referred to Volume II - ITS Project Implementation Guide.

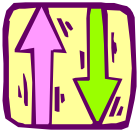
4.1 WHAT IS AN ARCHITECTURE?

What is an architecture and why is it important to know about architectures? In its most

“In its most basic form, an architecture is a set of rules that facilitates the building of systems and that allow these systems to communicate and inter-operate after being built.”

basic form, an architecture is a set of rules that facilitates the building of systems and that allows these systems to communicate and inter-operate after being built. An ITS architect is to an ITS system as a building architect is to a building. A building architect could not build a structure without a set of plans. Neither could an ITS architect build a

complex ITS environment without a set of plans. These plans are the system architecture. It is important to distinguish between an architecture built for planning and implementation guidance and an architecture used to design and build actual working systems. In our



discussions regarding this Strategic Plan, the former context is most appropriate, although a few insights will be provided on the latter.

4.2 WHAT IS THE NATIONAL ITS ARCHITECTURE?

4.2.1 What Does It Do?

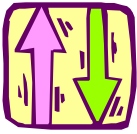
Since 1992, the U. S. DOT has been engaged in the development of the National ITS Architecture. Basically, it provides a framework and common vocabulary for planning, defining, and integrating ITS systems among modes of travel and geographic areas. The set-of-tools that comprise the National ITS Architecture provide a common information source in the following manner:

- Framework to identify system components and interconnections
- Vocabulary to better communicate with colleagues
- Guidance to help you develop a Regional ITS Architecture, and to identify integration opportunities during project definition

Furthermore, Section 5206 (e) of TEA-21 requires that ITS projects carried out using funds made available by the Highway Trust Fund conform to the National ITS Architecture, applicable provisional standards, and protocols. This is now more commonly referred to as “conformance” with the National ITS Architecture.

4.2.2 What Is It Made Of?

The National ITS Architecture's main objectives are to describe what functions/processes are needed, decide where these functions should be located, and identify who needs to be involved and/or is responsible. Basically, the Architecture consists of a series of diagrams/figures that show the relationships within/between components, subsystems, and agencies. Within the Architecture, these diagrams represent sample figures that can be tailored to a specific region such as the Central Coast. In subsequent sections of this chapter, the specific components of the Architecture that are used to show the Central Coast's conformance to the Architecture are further defined and diagrams uniquely tailored.



4.2.3 Why Is It Useful?

“Conformance with the National ITS Architecture ensures that ITS Projects in the Central Coast are eligible for Federal funding.”

The Central Coast should make use of the U. S. DOT's investment in the National ITS Architecture to develop a tailored Regional ITS Architecture that establishes a framework for deployment that guides Central Coast Stakeholders. A Regional ITS Architecture has

the potential to provide the following benefits:

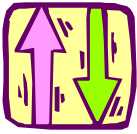
- Ensure that ITS Projects meet TEA-21's Architecture conformance requirements for Federal funding eligibility
- Lower costs and risk, both during design and over the entire project life-cycle
- Reduced development time
- Orderly and efficient expansion of systems/technologies
- Economies-of-scale by using technologies from multiple vendors that can still work together as a system
- Highlight and improve the integration of systems
- Use of a common set of standards to better coordinate operations, integrate systems, and share data/information
- Identify potential stakeholders interested in sharing data/information, thereby assisting in the current and future project planning and implementation process
- More coordinated operations among different agencies across the region

4.3 REGIONAL ITS ARCHITECTURE FOR THE CENTRAL COAST

4.3.1 What Is It?

“The Central Coast Regional ITS Architecture is created by tailoring specific National ITS Architecture diagrams.”

The Regional ITS Architecture is a description of "what" we want to do in the Central Coast. It describes the planned ITS services and functions, incorporates the relevant subsystems and organizations, and describes the information exchanges planned between them.



In the Central Coast, these relationships are illustrated by tailoring specific National ITS Architecture diagrams. From these tailored diagrams, a deployment plan structure is established that provides a basis for long-term transportation planning in the region. Then, mainstreaming ITS Projects into the planning process and promoting stakeholder buy-in across organizations should be easier since everyone is working-off-the-same-blueprint.

Another purpose of the Central Coast Regional ITS Architecture is to describe how individual ITS projects/applications work together as a system. In a sense, this would be the high-level ITS concept-of-operations for the Central Coast Region. The Regional ITS Architecture starts with the ITS Strategic Direction, then adds those selected ITS Projects and functional pieces which complete the view. In this manner, the National ITS Architecture was tailored to reflect the list of ITS Projects selected for the region. Therefore, the Central Coast Regional ITS Architecture was designed to accommodate anticipated projects (as described in Section 3), and vice-versa. By analyzing these selected projects, tailoring their functionality, and placing them within the framework of the Regional ITS Architecture, a clear picture of the Central Coast Agencies' intended operations becomes apparent.

4.3.2 How Was It Developed?

Exhibit 4.1 illustrates how the National ITS Architecture was used to develop a Regional ITS Architecture for the Central Coast. Basically, the first column (or Activity) represents the steps taken; the second column (or Arrows) represent the part of the National ITS Architecture that was used, and the third column (or Product) represents the deliverable. In addition, Exhibit 4.1 can also be used as a roadmap to find out where in the Strategic Plan specific Architecture tailoring activities are more fully described.

As can be seen from Exhibit 4.1, the basic process used to develop the Central Coast's Regional ITS Architecture is as follows:

- Inventory existing ITS systems
- Select Market Packages
- Evolve Market Packages into full-blown ITS Project Ideas
- Map existing and planned ITS systems to the Architecture
- Identify the desired connections between Agency systems
- Tailor data/information flows between systems

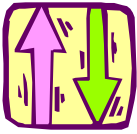
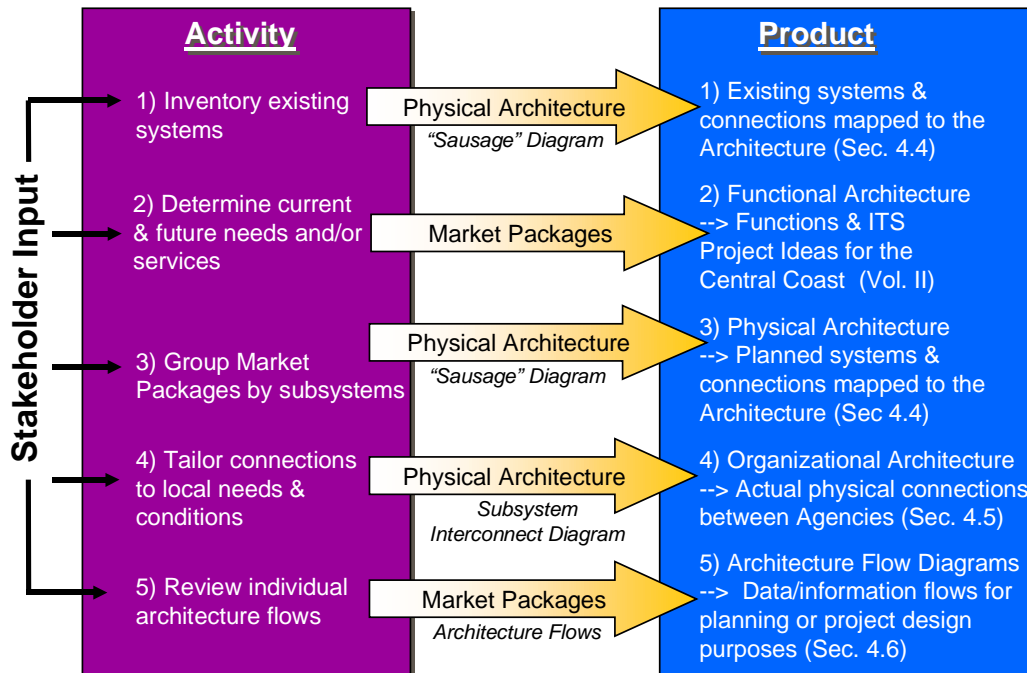


Exhibit 4.1 - How the National ITS Architecture was used to Develop the Central Coast Regional ITS Architecture



The following sections provide a detailed description of the specific components which makeup the Central Coast's Regional ITS Architecture; that is, the Physical Architecture, Organizational Architecture, and Architecture Flow Diagrams.

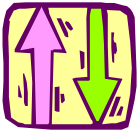
4.4 PHYSICAL ARCHITECTURE

4.4.1 What Is It?

The major building block of the National ITS Architecture is the Physical Architecture. The

"The Physical Architecture's primary purpose is to group/allocate the Central Coast's selected functions (or Market Packages) to physical subsystems."

Physical Architecture's primary purpose is to group/allocate the Central Coast's selected functions (or Market Packages) to physical subsystems. Once this is complete, the Physical Architecture then provides the initial look at establishing the interconnections between various subsystems.



4.4.2 What It Looks Like -- Regional View

The first job was to tailor the Physical Architecture diagram to reflect those subsystem components and interconnections selected for the entire Central Coast Region. It was decided that the best way to tailor this information was to present it in three different ways (or diagrams):

- Existing systems
- Proposed systems
- Combined systems (both existing and proposed)

In this manner, the Central Coast will be able to see what they already have (existing), what they want (proposed), and what they will eventually end-up with (combined). Therefore, separate Physical Architecture diagrams have been tailored from the National ITS Architecture at the Central Coast regional level for each of the above areas. Exhibit 4.2 presents the Central Coast's combined regional view. Please refer to Volume II - ITS Project Implementation Guide for the full suite of tailored Physical Architecture diagrams for the Central Coast Regional View.

Exhibit 4.2 - Central Coast Physical Architecture – Combined Regional View

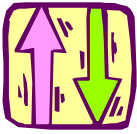
Error! Not a valid link.

4.4.3 What It Looks Like - County-by-County View

The next step was to take the Central Coast Regional View and tailor these to a specific county. This means that existing, proposed, and combined Physical Architecture diagrams were tailored for each of the five counties in the Central Coast. What separates these views from the Regional View is that additional levels-of-detail are provided to further strengthen the bond between Market Packages, ITS Project Ideas, and the Regional ITS Architecture. Individual Market Packages within each subsystem as well as specific Agency-owned components (or ITS Project Ideas) within each Market Package are presented. Exhibit 4.3 presents the Physical Architecture diagram as tailored to reflect Santa Cruz County's existing view. Please refer to Volume II - ITS Project Implementation Guide for the full suite of tailored Physical Architecture diagrams for each Central Coast County.

Exhibit 4.3 - Santa Cruz County – Existing Systems/Centers

Error! Not a valid link.



4.4.4 Why Is It Useful?

The Physical Architecture is useful to the Central Coast's stakeholders for the following reasons:

- Groups/allocates functions and ITS Project Ideas
- Establishes the initial physical connections between Agency subsystems
- Provides key materials/diagrams to establish conformance with the National ITS Architecture

4.5 ORGANIZATIONAL ARCHITECTURE

4.5.1 What Is It?

The main reason behind developing an Organizational Architecture for the Central Coast

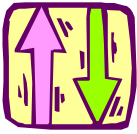
"The main reason behind developing an Organizational Architecture for the Central Coast region is to determine just "who" will be connected to one another.

region is to determine just "who" will be connected to one another. In this sense, "connected" means what Agency systems will be physically linked by communications, and therefore, what Agency systems are sharing data. While developing the Physical Architecture in the previous section, an initial indication of who was the owning and/or

responsible Agency was provided. The Organizational Architecture takes this one step further by explicitly grouping each subsystem by Agency ownership, establishing the "actual" physical interconnections (not just representative ones as provided in the Physical Architecture diagram), and graphically illustrating the Agency/subsystem hierarchy through a series of interconnect diagrams.

4.5.2 What Does It Look Like?

Basically, the Organizational Architecture diagrams will look like a series of Agency-owned systems linked/connected to other Agency-owned systems. The key is determining the appropriate sequence/relationship(s) that indicate "who's-talking-to-who". To develop the Organizational Architecture, the FHWA's database tool called "Turbo Architecture" (or Turbo) was used to tailor Agency relationships in the Central Coast. Turbo is a high-level,



interactive software program created by the FHWA and Architecture Development Team to facilitate usage of the National ITS Architecture. For the Central Coast, seven Organizational Architecture diagrams will be developed. One for each county, one for AMBAG, and one for the entire Central Coast region. These can be found in Volume II - ITS Project Implementation Guide. For now, Exhibit 4.4 provides a representative example of what these diagrams will look like.

Exhibit 4.4 - Central Coast Organizational Architecture - Representative Regional View

Error! Not a valid link.

4.5.3 Why Is It Useful?

The Organizational Architecture is useful to the Central Coast's stakeholders for the following reasons:

- Groups subsystems by Agency ownership
- Depicts which Agency subsystems are connected to one another
- Provides an initial indication of the hierarchical relationships that exist for the Central Coast Agencies

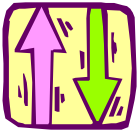
4.6 ARCHITECTURE FLOW DIAGRAMS

4.6.1 What Are They?

Basically, architecture flows are the primary data/information flows that can exist between subsystems that make-up a Market Package. Because of this, they are arguably the key tools to show conformance with the National ITS Architecture. Through architecture flows, you have a common denominator from which to compare/tailor functionality, system/projects to install, and people/Agencies to talk to.

4.6.2 What Do They Look Like?

Exhibit 4.5 provides a representative example of the architecture flows that comprise the Incident Management Market Package (ATMS08) and the specific tailoring approach that was used in the Central Coast. As can be seen, the architecture flows have been tailored to reflect existing, future option, and not applicable flows. The full suite of tailored architecture



flow diagrams for every Market Package selected for the Central Coast can be found in Volume II – ITS Project Implementation Guide.

4.6.3 Why Are They Useful?

The Architecture Flow diagrams are useful to the Central Coast's stakeholders for the following reasons:

- Identifies what data/information flows exist between subsystems
- Establishes the initial data flows from which more detailed ITS project designs can be based
- Provides key materials/diagrams to establish conformance with the National ITS Architecture.

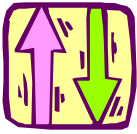
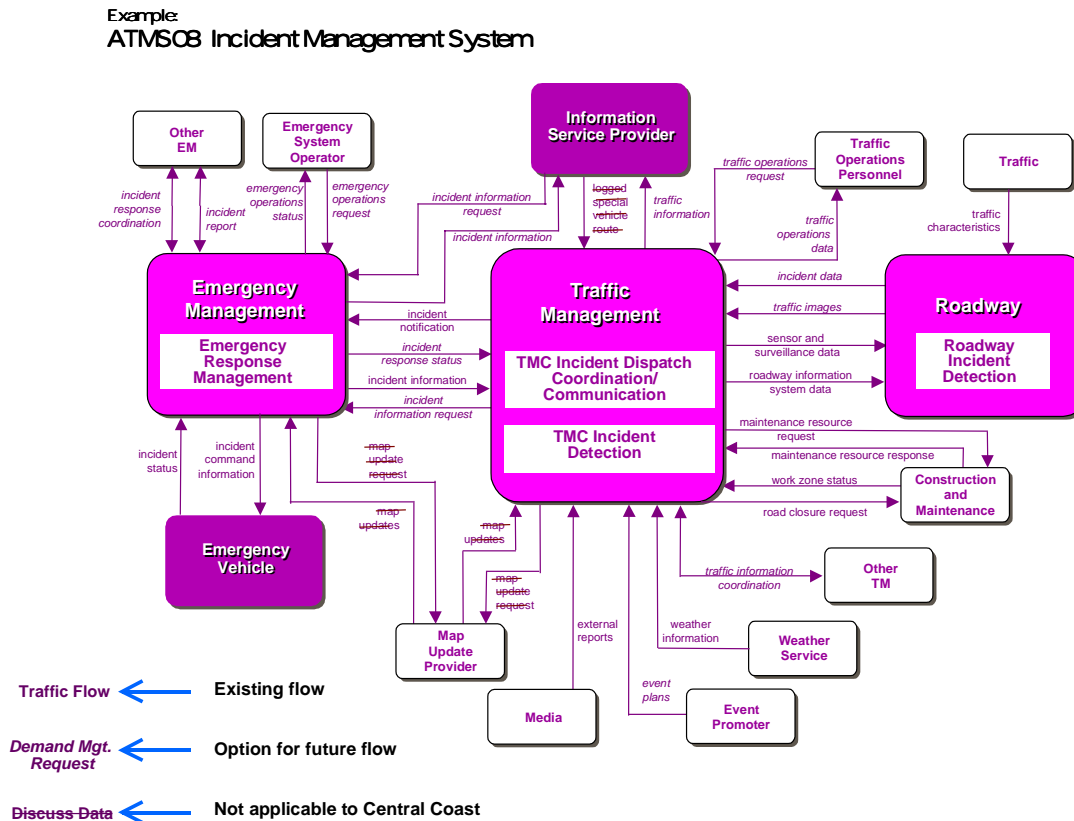


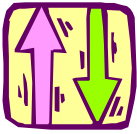
Exhibit 4.5 - Representative Architecture Flow Diagram



4.7 CONFORMANCE WITH THE NATIONAL ITS ARCHITECTURE

4.7.1 What Is the Reason for Architecture Conformance?

As we have discussed, the National ITS Architecture is a common framework for the design and implementation of ITS. Because of its strategic role, the Transportation Efficiency Act for the 21st Century (TEA-21) requires the U.S. DOT to ensure that Federally-funded ITS Projects conform to the National ITS Architecture and approved standards. Conformance with the National ITS Architecture is interpreted to mean the use of the National ITS Architecture in developing a local implementation of the National ITS Architecture, referred to as a Regional ITS Architecture, and the subsequent adherence of all ITS Projects to that



Regional ITS Architecture. Development of the Regional ITS Architecture begins with the transportation planning process and the development of an ITS Strategic Plan or integration strategy. The Regional ITS Architecture will guide the development of specific projects and programs.

4.7.2 What Is Expected From Project Conformance?

During project implementation, the following results are expected from a project conformance analysis:

- The project specifications shall ensure that the project accommodates the sharing of electronic information and provides for the functionality and operations (both at the time of project implementation and in the future) between the agencies and jurisdictions as indicated in the Strategic Plan and Regional ITS Architecture.
- The project shall use applicable ITS standards that have been officially adopted by the U.S. DOT
- The ITS standards that are pertinent to the project should be used as they become available, prior to adoption by the U.S. DOT.

Further information on conformance with the National ITS Architecture can be found in Volume II – ITS Project Implementation Guide.